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Abstract

The Lucens experimental nuclear power station

by

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Swiss industry, supported by most of the electric utilities of the country and by the Federal Government, is concentrating on the development of a single reactor type based on the pressure tube design with heavy water moderation.

The Lucens reactor is a first prototype along that line. It is cooled by carbon dioxyde. The fuel is metallic uranium, very slightly enriched due to the small size of the core, and canned with a magnesium alloy. In order to achieve a high power density, the fuel is subdivided in bundles of 7 rods per element. The mean coolant pressure is set at 60 at. Radial flattening of the neutron flux is achieved by dividing the core in two zones, the inner one having a smaller lattice-pitch. Control rods are driven in sequence, a design feature which will tend to flatten the axial burn-up distribution.

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Due to the thimble design of the pressure tubes, the hair pin coolant flow keeps the tube walls close to the cold leg temperature of the primary circuit. Furthermore it is possible to remove the pressure tubes easily with the fuel discharge-machine. This will be particularly useful for in-core testing of fuel elements of various designs.

Gas outlet temperature of the element is fixed at 380°C although the plant is designed for a higher temperature which may later be achieved by improved fuel elements.

The nominal thermal power of the reactor is 30 MW and the net electric power of the station is about 7 MW. A simple thermodynamic cycle has been selected for the plant without endeavouring to optimalize its efficiency.

The power station is built underground and is divided in three caverns, a reactor hall as containment with the reactor and the primary circuit, a fuel storage cavern and a turbine hall in which the turbine-generator set and its ancillary equipment are located. A service building houses the control room, electrical installations, offices, workshops and laboratories. In addition the site comprises a waste treatment plant, cooling towers, the river pumping station and a ventilation plant.

The total cost of the station is estimated at 70 million Swiss francs excluding heavy water and fuel. The station is presently under construction; start-up is scheduled for the end of 1965.